

# Computer-Assisted Assessment of Family Physicians' Knowledge About Cancer Screening Guidelines

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*The understanding and correct application of cancer screening guidelines is an important aspect of early cancer detection. Prior reports have indicated deficiencies in physicians' knowledge of the subject, prompting various educational activities aimed at primary care physicians. By using an interactive computer program to assess knowledge of the American Cancer Society cancer screening guidelines in a group of 306 family physicians, we found that knowledge of this subject continues to leave room for improvement.*

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**T**he American Cancer Society (ACS) estimates that of the 450,000 Americans who died of cancer in 1984, about 148,000 could have been saved by earlier diagnosis and prompt treatment.<sup>1</sup> Hence, an important aspect of cancer control lies in the application of currently available cancer screening and preventive measures to a larger segment of the general population.

Family physicians have a unique opportunity to provide accurate patient education information and to do the procedures necessary to effect an early diagnosis.<sup>2</sup> In 1980, therefore, the ACS published guidelines for the cancer-related checkup that reviewed their recommendations for screening for the four major internal cancers: breast, cervix, colon and lung.<sup>3</sup> The stated goal of the ACS is that "since the burden of prevention and early detection of cancer rests primarily on the doctor who first sees the patient, the Society's professional education program is particularly directed to the primary care physician."<sup>4</sup>

In an effort to determine the effectiveness of this strategy, the ACS studied primary care physician knowledge about cancer screening guidelines and found that 80% of California physicians reported not being exposed to ACS materials or programs.<sup>5</sup> In a similar ACS report, a study of 35 residents in a family practice residency program showed that 64% of the residents had never been involved in educational activities specifically dealing with cancer prevention and detection and

that few residents could correctly state or apply the guidelines.<sup>6</sup>

We describe current knowledge of a group of family physicians about cancer screening guidelines and test the efficacy of the microcomputer in knowledge assessment and interactive teaching. The microcomputer was felt to be ideally suited for assessing physician knowledge because of the considerable interest in this technology, ease of keyboard use, personalized interactive teaching style and response storage capabilities.<sup>7</sup>

### Methods

As a volunteer project under the auspices of the California Division of the American Cancer Society, the two physician-authors programmed a 20-minute computer-assisted cancer screening questionnaire and instructional program for the Apple IIe computer. The program contained questions related to physician age, sex and board certification and included 11 questions regarding the ACS guidelines for the cancer-related checkup. Questions were of the multiple choice, true-false and fill-in-the-blank type. A "menu" was used so that physicians could select from one to all four of the course sections: breast, cervix, colon and lung. The program included an optional tutorial on the use of the computer keyboard. Graphics, sound effects and positive reinforcement were used to make the interaction pleasant and entertaining. Following each phy-

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sician response, interactive instruction was tailored to the accuracy of that response. On one of the cervix section questions, a second interrogation was designed to test the efficacy of the computer in facilitating short-term knowledge retention.

To ensure that the program included key concepts primary care physicians should know, the content of the program was reviewed and approved by the Professional Education Subcommittee of the California Division of the American Cancer Society. Each question was presented on two occasions to a group of five physicians during diskette development and minor modifications were made to question content and format to improve the clarity and reliability of the questionnaire. The program was then presented to family physicians as a scientific exhibit at a meeting of the California Academy of Family Physicians held November 9 to 11, 1983, in San Francisco. Twelve computers were made available during the three-day convention to maximize physician participation. Physician responses were stored on diskette for later analyses.

The association between test performance and various factors (age, sex, board certification, need for keyboard review) was tested using the Mantel-Haenszel  $\chi^2$  procedure corrected for continuity.<sup>8</sup> Age was stratified in three groups: 21 to 40 years, 41 to 60 years and over 60 years. *P* values were derived from  $\chi^2$ s in each factor-course table using the 5% level for statistical significance.

## Results

A total of 306 family physicians participated by interacting with the computer on at least one of the four sections of the program: 68% took all four, 7% took three, 11% took two and 13% took only one. The course sections were nearly equally popular (Table 1).

Age was directly related to whether a physician requested a computer-assisted tutorial on the use of the computer keyboard (Table 2). Need for keyboard review was independent of board certification, sex and overall test performance.

Overall test scores (for four sections combined) were not significantly correlated to age, sex or board certification (see Table 3). Analysis of data for the individual course sections showed that board certification and sex were unrelated to section performance. Age, however, was significantly correlated on the lung and colon sections, with older physicians doing less well (see Table 4).

In cervix question C-2 (see below), second interrogation scores were tabulated for those physicians who initially gave an incorrect response and who then received interactive computer-assisted instruction on the subject matter. Correct responses were attained in 97% of repeat responders to this question.

Data related to performance in each of the test sections are presented in Table 5.

### Breast Cancer

Although 90% of responders correctly answered that fine-needle aspiration or biopsy was necessary in patients with a suspicious breast mass and a negative mammogram (question B-2), only 55% correctly answered concerning the guidelines that a mammogram should be done as a baseline in asymptomatic women between the ages of 35 and 40 years,

every one to two years between the ages of 40 and 50 years and yearly thereafter (question B-1). Of responders, 23% would have incorrectly delayed dye- or needle-guided biopsy in the case of a "suspicious area on screening mammogram, but with a normal physical examination" (question B-3).

### Cervix Cancer

Only 40% of responders recognized that the American Cancer Society guideline "Pap smears every three years after two negative exams a year apart" was based on all three of the following factors: (1) the time for transformation of carcinoma in situ to invasive carcinoma of the cervix is 8 to 30 years; (2) of women who have had at least one negative Pap test, only 1 in 50,000 women screened will have invasive

TABLE 1.—Number and Percentage of Family Physicians Participating in the Cancer Screening Guidelines Test by Course Section

Course	Physicians	
	Number	%
Breast .....	254	83
Cervix .....	251	82
Colon .....	249	81
Lung .....	256	84
Any course .....	306	100

TABLE 2.—Percentage of Physicians, by Age Group, Requesting Computer-Assisted Keyboard Tutorial

Age Years	Physicians	
	Number	%
21-40 .....	117	52.1
41-60 .....	119	63.9
> 60 .....	70	85.7

*P* < .001

TABLE 3.—Relationship of Total Score to Various Factors

Factor	Mantel-Haenszel	
	$\chi^2$	<i>P</i>
Keyboard review .....	0.15	> .5
Age .....	1.15	.33
Sex .....	0.27	> .5
Board certification .....	2.42	.12

TABLE 4.—Statistical Significance\* of Association of Factors With Section Scores

Section		Factor		
		Age	Sex	Board Certification
Breast	$\chi^2$ .....	0.08	0.88	1.45
	( <i>P</i> ) .....	(.93)	(.35)	(.23)
Cervix	$\chi^2$ .....	2.57	0.53	2.72
	( <i>P</i> ) .....	(.11)	(.47)	(.10)
Colon	$\chi^2$ .....	10.09	0.82	0.68
	( <i>P</i> ) .....	(.0015)	(.36)	(.42)
Lung	$\chi^2$ .....	5.29	0.00	0.65
	( <i>P</i> ) .....	(.021)	(1.00)	(.42)

\*One degree of freedom Mantel-Haenszel  $\chi^2$  and *P* value.

cancer, and (3) there is a definite regression rate from carcinoma in situ back to normal that one can take advantage of by screening less frequently (question C-1).

In all, 63% of responders understood that the ACS guidelines called for Pap smears only until age 65 (question C-2).

### Colon Cancer

Of responders, 57% were aware that if colon cancer was detected early (Duke's stage A), the five-year survival rate exceeds 80% (question CR-1). However, 95% of respondents correctly answered that the ACS guidelines included digital rectal examination, occult blood testing and sigmoidoscopy as screening tests (question CR-3); 93% of responders understood that the sigmoidoscope was still a useful screening tool, even though the location of colorectal cancer had seemingly been moving "higher in the bowel" (question CR-2).

### Lung Cancer

Only 23% of responders were able to identify that the five-year survival for a detected lung cancer, even with screening chest roentgenogram and careful history, remained 8% (question L-1). A total of 60% of responders incorrectly felt that there was "no harm" in obtaining screening chest roentgenograms and cytologic analysis of sputum specimens in patients who desired the tests and could afford them (question L-2). In all, 81% of responders correctly identified that the key to preventing lung cancer was to stop smoking cigarettes (question L-3).

### Discussion

This study shows that family physicians' knowledge of American Cancer Society screening guidelines varies. Indeed, on more than half of the test questions, less than 65% of responses were correct. Board certification, age and sex had no significant effect on overall test scores, but older physicians did less well on the lung and colon sections.

Knowledge of mammography guidelines was marginal for

both men and women physicians, which seems surprising considering recent media attention concerning this procedure. Physicians were also much more inclined to do a biopsy in the clinical setting of a "suspicious mass on physical exam, but with negative mammogram" (90%) than they were to do a biopsy in the setting of a "suspicious mammogram with negative physical exam" (77%). Apparently 23% of the physicians relied so heavily on the physical examination that they would disregard the suspicious findings on a mammogram. The Breast Cancer Detection Project clearly has shown that mammography is the most accurate single examination for breast cancer detection. Indeed, of the 3,557 breast cancers detected in that study, 41.6% were detected by mammogram alone.<sup>9</sup>

Also noteworthy was the percentage of responders (60%) who felt that there would be "no harm" in doing screening chest roentgenograms and cytologic studies of sputum in patients who desired the tests and could afford them. These studies are not recommended as screening tests for high-risk groups because of the high rate of false-positive results (up to 10%), which can lead to invasive procedures such as bronchoscopy and thoracotomy; in addition, screening with chest roentgenogram and cytology has not been shown to improve the outcome in patients with lung cancer.<sup>3</sup>

Age was directly related to whether a physician required a keyboard lesson in the use of the computer. Younger physicians were much less likely to require a review, possibly indicating they are more familiar with computer technology or have already been exposed to the use of a computer keyboard. However, that overall performance was independent of the need for a keyboard review suggests that proficiency in the use of the keyboard was readily gained by those (including older physicians) who completed the computer-assisted tutorial.

The computer was shown to be a valuable teaching aid for acquiring short-term knowledge when one looks at the data for second interrogation on question C-2. Initial correct re-

TABLE 5.—Number of Participants and Percentage Correct by Question

Section Correct Answers	Percentage Correct %
<i>Breast (N = 254)</i>	
B-1 Age-related guidelines for mammography (see text) . . . . .	55
B-2 If a suspicious mass is found but mammogram is negative, aspiration or biopsy should be done . . . . .	90
B-3 If mammogram is suspicious but exam is negative, next step would be dye or needle-guided biopsy . . . . .	77
<i>Cervix (N = 251)</i>	
C-1 Rationale for Pap smears every 3 years after two negative smears a year apart (see text) . . .	40
C-2 Pap smears are only recommended until age 65 if exams have been negative previously . . .	63
<i>Colon (N = 249)</i>	
CR-1 Survival rate for a patient with a cancer detected early (Duke's stage A) is greater than 80% . .	57
CR-2 Sigmoidoscopy is still a useful screening test even though cancers have been moving "higher in the bowel" . . . . .	93
CR-3 ACS asymptomatic screening protocol (see text) . . . . .	95
<i>Lung (N = 256)</i>	
L-1 Survival rate for a patient with a detected lung cancer (if screening CXR and sputum cytolo- gies had been done every 6 months) is the same as if no screening had been used (8%) . .	23
L-2 CXR and sputum cytology do have the risk of leading to more invasive tests and are not recommended for screening . . . . .	40
L-3 For lung cancer prevention, the physician should recommend smoking cessation . . . . .	81

ACS = American Cancer Society, CXR = chest x-ray study

sponses were 63% to this question, but after interactive instruction, 97% of those who initially answered incorrectly were able to give a correct response on a second interrogation.

Two possibilities may explain the deficiency in cancer screening guideline knowledge. The American Cancer Society may have been ineffective in disseminating the information concerning the application of their guidelines, or physicians may have been exposed to these guidelines in the past but have rejected them and therefore do not recall their specifics. It is the authors' opinion that the former is the major factor operating. The data presented here are consistent with other studies on the subject.<sup>5,6</sup>

Possible implications of the study would be (1) that family practice residency programs review the adequacy of the cancer curriculum presented during residency; (2) that family physicians in practice might review current patient education and preventive measures in their practices, and (3) that large

funding agencies such as the American Cancer Society consider enhancing or redirecting their professional education programs toward primary care physicians.

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